proportion of the difference between the final range between the boiler and atmosphere or other lower limit of temperature and the range between the firebox temperature and the same lower limit. If the absolute furnace temperature is 2000° C., boiler temperature 500° C., and condenser temperature 350°, for example, the availability of the heat generated by combustion is reduced at the first step from (2000–350) /2000 = 0.825 to (500–350) /500 = 0.30; even though the most perfect of thermodynamic engines is employed.

"But though the second law is scientifically precise and incontrovertible, it is hard at first to realize how and why it can be true that the temperature which exists in bodies so entirely controls its availability or working power." This the author proceeds to explain by reference to illustrations in other fields of energetics. The deduction follows:

"The transferable portion of heat is to the whole heat as the available difference of temperature is to the whole temperature above absolute zero. Hence the efficiency of transfer is equal to the ratio of the available difference of temperature to the maximum absolute temperature."

This is Professor Lodge's enunciation of the second law of thermodynamics. It follows that "A working substance above average pressure has some available mechanical energy; a working substance below average temperature has some available thermal energy, but a substance at average pressure and temperature has no available energy."

"The second law of thermodynamics relates to the utilization of heat energy *as heat*, *i. e.*, as irregular and uncontrollable molecular motion. If, by any means, molecular motion could be taken under control, it would cease to be heat—the second law of thermodynamics would not apply to it—and a much greater portion of its energy might become available." Thus "Animals do not turn their food energy into heat, but utilize it direct. They are not heat engines. If they were, they would be miserably inefficient because of their low temperature; but they are chemical engines, analogous to the electric battery and are marvellously efficient."

A working substance, for use in any heat engine, must have the following qualifications to insure efficiency:

1. It must have great capacity for heat.
2. It must be able to sustain high temperature.

By utilizing the whole difference of temperature between the furnace and the surrounding bodies, any heat engine, as, for example, the gas engine, is seen to involve, according to the laws of thermodynamics, a possibility of raising the efficiency of the heat engine, "not five or six per cent., which is almost all the present difference between the best steam engines and the worst, but to a revolutionary change of fifty or sixty per cent; no drop of temperature being permitted from furnace to everyday temperature, without delivering up its due equivalent of motive power."

R. H. T.

SOCIETIES AND ACADEMIES.

ALABAMA INDUSTRIAL AND SCIENTIFIC SOCIETY.

THE annual meeting of this Society was held in Birmingham on the 8th instant. The officers elected for the ensuing year are Mr. Thomas Seddon, President, and Messrs. E. A. Uehling and C. E. Bowron, Vice-Presidents; Messrs. Eugene A. Smith and Henry McCalley were continued as Secretary and Treasurer respectively. The retiring President, Dr. Wm. B. Phillips, in his address before the Society, gave some particulars of the experiments conducted by him in Bessemer for the concentration of the Red Mountain (Clinton) ores. This

concentration is effected by making the ore magnetic by roasting in a suitable furnace in contact with producer gas, then after crushing to small size passing it over a magnetic separator, when the silica is thrown off and the iron ore remains to fall into a bin. The experiments have been carried far enough to demonstrate the fact that concentration may be carried out which will make available the stratum of ore hitherto thrown aside as too high in silica for profitable working. The carrying out of this process on a commercial scale would mean a great deal for the Birmingham district.

The subject set for discussion at this meeting was the utilization of the by-products of the coking ovens, and on this Mr. A. J. Montgomery read a paper of much interest. The next meeting of the Society will be held in the autumn.

Eugene A. Smith,
Secretary.

ST. LOUIS ACADEMY OF SCIENCE.

The Academy held its regular meeting on June 17th, with President Green in the chair and 25 members and visitors present.

Dr. C. R. Sanger spoke of the Chemistry of Photography, dividing his discourse into the following headings: (1) The Formation of the Latent Image. (2) The Development of the Latent Image. (3) The Fixation of the Developed Image. (4) The Printing of the Positive. (5) The Toning of the Positive.

Adjourned until the third Monday in October.

A. W. Douglas,
Recording Secretary.

SCIENTIFIC JOURNALS.

THE AMERICAN JOURNAL OF SCIENCE.

The July number of the *American Journal of Science* commences the fiftieth and closing volume of the *third* series; it is the one hundred and fiftieth volume since the Journal was established in 1818. The opening article is by Frank Leverett, on the Correlation of New York moraines with raised beachs of Lake Erie. The investigation here detailed is in continuation of the work earlier done by the same author (the results published in 1892) in tracing the connection between the raised beaches of the western portion of the Erie basin and certain moraines in Ohio. It is a department in which G. K. Gilbert had also made extensive investigations previous to this time, notably in 1886. The names given to the successive beaches are those suggested by Mr. Gilbert, viz., the upper or Sheridan Beach, traced by Gilbert from Cleveland eastward to Sheridan, N. Y., which may be a continuation of the western Belmore Beach and the lower Crittenden Beach, especially investigated to the eastward near Hamburg. A map is given by Leverett, of the region under discussion, showing the position of the beaches and the moraines and other related features exhaustively treated in this article. The author reaches some important conclusions, which, however, hardly admit of brief statement; one point made relates to the successive outlets of the lake during the glacial times. A paper by H. L. Wells describes, as a continuation of former work in a similar subject, two remarkable chemical compounds containing lead and extra iodine. These are Johnson's salt for which the formula $5Pb(CH_3CO_2)_2 .3KI .6I$ or perhaps $5Pb(CH_3CO_2)_2 .3KI_3$ is deduced and Gröger's salt with the formula $PbI_2.PbO.3I.H_2O$.

Two papers on analytical chemistry come from the laboratory of F. A. Gooch, the first embodying the results of work by himself and Charlotte Fairbanks in the estimation of the halogens in mixed silver salts, and the second with C. F. Clemons on the determination of selenious acid by potassium permanganate. S. F. Peckham, in a paper upon the Pitch lake of Trinidad, de-